# Stability and functionality of xanthan gum–shellac nanoparticles for the encapsulation of cinnamon bark extract

## ABSTRACT

The aim of this study was to prepare stable shellac nanoparticles containing a cinnamon bark extract using xanthan gum by anti-solvent precipitation. The nanoparticles were characterized in terms of their gastric pH stability, surface charge, particle size and morphology. The effect of the cinnamon extract loading on the properties of the nanoparticles, including the encapsulation efficiency and antioxidant properties, were also investigated. Ultimately, the release behaviour and the thermal stability of the nanoparticles were established. The results showed that xanthan gum can stabilise shellac nanoparticles at gastric pH by electro-steric stabilisation. The morphological analysis of the nanoparticles by Cryo-SEM showed that spherical particles with a smooth outer surface were formed. A decrease in encapsulation efficiency was observed when a higher level of cinnamon extract loading was used. The bioparticles fortified with cinnamon extract exhibited antioxidant activity and ferric-reducing antioxidant power at the level of 185 mg tannic acid equivalent and of 127 mM ascorbic acid equivalent per gram dry weight of nanoparticles, respectively. From the release study, it was shown that more than 90% of cinnamon polyphenol was released at the intestinal pH. Nanoencapsulation effectively improved the thermal stability of the polyphenol-rich cinnamon extract. The polyphenol retention after heat treatment (90 °C, 20 min) was still higher than 90%. This study presents the formulation of cinnamon extract containing nanoparticles, which may be applicable in the food industry as a prospective antioxidant agent.